

- 1) Why do the planets appear to move with respect to the stars?**
 - It has been observed that positions of stars remain fixed relative to each other but that the whole star field slowly revolves around a fixed point.

- 2) Contrast the geocentric and heliocentric Universe concepts.**
 - Geocentric: the Earth is motionless and the Sun & all other planets revolve around it
 - Heliocentric: all planets, including Earth, revolve around the Sun

- 3) Describe how Foucault's pendulum demonstrates that the Earth is rotating on its axis.**
 - As the pendulum continued to swing, the plane lying perpendicular with Earth's surface appeared to rotate around a vertical axis. With this being said, Newton's first law of motion (objects in motion remain in motion & object at rest remain at rest) required that the Earth be rotating under the pendulum while the pendulum continued to swing in place.

- 4) How did Eratosthenes calculate the circumference of the Earth?**
 - He estimated that at noon in Syene the Sun made a straight angle, so he measured the shadow cast by a tower at noon in Alexandria, a town 800km North. With this being 7.2 degrees, he measured, in a straight line, the distance from Alexandria to Syene (0.1572km) and calculated the circumference within 2% of today's accepted value.

- 5) Imagine you hear the main character in a cheap science-fiction movie say he will "return 10 light years from now." What is wrong with his usage of the term "light year"? What are light years actually a measure of?**
 - Light years are the distance that light travels in one Earth year. His usage of this term is incorrect because it is not a measure of time, it is a measure of distance.

- 6) Describe how the Doppler effect works.**

- When waves are closer together, they have a higher frequency than when they are farther apart (they have a low frequency).

7) What does the red shift of the galaxies tell us about their motion with respect to the Earth?

- They are all moving rapidly away from Earth

8) Briefly describe the steps in the formation of the Universe and the solar system.

- Universe:
 - i. The Big Bang Theory: cataclysmic explosion that scientists suggest represents the formation of the Universe; before this event, all matter & energy were packed into one volumeless point.
- Solar System:
 - i. A nebula forms from hydrogen and helium left over from the big bang, as well as from heavier elements that were produced by fusion reactions in stars or during explosions of stars.
 - ii. Gravity pulls gas and dust inward to form an accretionary disk; eventually a glowing ball (the proto-Sun) forms at the center.
 - iii. Dust concentrates in the inner rings while ice concentrates in the outer rings; eventually the dense ball of gas at the center of the disk becomes hot enough for fusion reactions to begin, and when it ignites it becomes the Sun.
 - iv. Dust and ice particles collide and stick together, forming planetesimals.
 - v. Planetesimals grow by continuous collisions.

9) How is a supernova different from a normal star?

- A supernova is a star that has died out by a violent explosion.

10) Why do the inner planets consist mostly of rock and metal, but the outer planets mostly of gas?

- When the Sun ignited, it sent out a stellar wind that blew out all gases on the inner planets, but was not strong enough to rid any remaining gases of the outer planets.

11) Why are the planets in the solar system (except Pluto) orbiting the Sun in the same direction and in the same plane?

- Because of the nebular theory, stating that stars and planets form when gravity pulls gas, dust, and ice together to form a swirling disk, the center of this disk becomes a star, and rings around the star condense into planetismals which combine to form planets.